CLAIMS

The invention claimed is:

1. A method for producing a polarized laser beam with minimum divergence and a desired spatial cross-section, comprising:

emitting a laser beam from optical fibers;

configuring the optical fibers with a spatial cross-section in a shape that is one-half the shape of the desired cross-section;

splitting the laser beam emitted from the configured optical fibers into a first component beam with a spatial cross-section and a second components beam with a spatial cross-section;

circularly polarizing the first and second component beams;

focusing the first and second component beams at a focal point;

inverting the spatial cross-section of one of the component beams compared to the spatial cross-section of the other component beam; and

combining the first and second component beams at or near the focal point so that they are aligned and contiguous or nearly contiguous.

2. A system for producing a polarized laser beam with minimum divergence and a desired spatial cross-section, comprising:

optical fibers emitting a laser beam configured with a spatial cross-section in a shape that is one-half the shape of the desired cross-section;

means for splitting the laser beam emitted from the configured optical fibers into a first component beam with a spatial cross-section and a second component beam with a spatial cross-section;

means for circularly polarizing the first and second component beams;

means for focusing the first and second component beams at a focal point;

means for inverting the spatial cross-section of one of the component beams compared to the spatial cross-section of the other component beam; and

means for combining the first and second component beams at or near the focal point so that they are aligned and contiguous or nearly contiguous.

3. The system of claim 2 wherein the means for splitting the laser beam comprises a beam-splitter polarizing cube.

4. The system of claim 2 wherein the means for polarizing the first and second component beams comprises two quarter wave plates, positioned with a fast axis of either + 45° or -45° relative to the vertical so an to achieve the desired direction of circular polarization.

5. The system of claim 2 wherein the means for focusing the first and second component beams are two converging lenses with common focal lengths.

6. The system of claim 2 wherein the means for inverting the spatial cross-section of one of the component beams compared to the spatial cross-section of the other component beam is a mirror.

7. The system of claim 2 wherein the means for combining the first and second component beams is a mirror.

8. The system of claim 2 wherein the means for combining the first and second component beams is a prism.

9. A system for producing a polarized laser beam with minimum divergence and a desired spatial cross-section, comprising:

optical fibers emitting a laser beam configured with a spatial cross-section that is one-half the desired cross-section;

a polarizing cube for splitting the laser beam into a first component beam and a second component beam;

two quarter wave plates positioned with a fast axis of + 45° or - 45° relative to the vertical so as to achieve the desired direction of circular polarization;

a first converging lens for focusing the first component beam at a focal point and a second converging lens with a common focal length with the first converging lens for focusing the second component beam of at the focal point;

a mirror for inverting the spatial cross-section of one of the component beams compared to the spatial cross-section of the other component beam; and

a mirror for combining the first and second component beams at or near the focal point so that they are aligned and contiguous or nearly contiguous.

10. A system for producing a polarized laser beam with minimum divergence and a desired spatial cross-section, comprising:

optical fibers emitting a laser beam configured with a spatial cross-section in a shape that is one-half the shape of the desired cross-section;

means for splitting the laser beam emitted from the configured optical fibers into a first component beam with a spatial cross-section and a second component beam with a spatial cross-section;

means for linearly polarizing in the same plane the first and second component beams;

means for focusing the first and second component beams at a focal point;

means for inverting the spatial cross-section of one of the component beams compared to the spatial cross-section of the other component beam; and

means for combining the first and second component beams at or near the focal point so that they are aligned and contiguous or nearly contiguous.

11. A method for producing a polarized laser beam with minimum divergence, comprising:

emitting a laser beam from optical fibers;

splitting the laser beam emitted from the configured optical fibers into a first component beam with a spatial cross-section and a second components beam with a spatial cross-section;

circularly polarizing the first and second component beams;

focusing the first and second component beams at a focal point; and

combining the first and second component beams at or near the focal point so that they are aligned and contiguous or nearly contiguous.

12. A system for producing a polarized laser beam with minimum divergence, comprising:

optical fibers emitting a laser beam;

means for splitting the laser beam emitted from the configured optical fibers into a first component beam with a spatial cross-section and a second component beam with a spatial cross-section;

means for circularly polarizing the first and second component beams;

means for focusing the first and second component beams at a focal point; and

means for combining the first and second component beams at or near the focal point so that they are aligned and contiguous or nearly contiguous.